NON-PUBLIC?: N
ACCESSION #: 9408100284
LICENSEE EVENT REPORT (LER)

FACILITY NAME: South Texas Unit 2 PAGE: 1 OF 5

DOCKET NUMBER: 05000499

TITLE: Turbine Trip and Reactor Trip Due to Main Transformer
Lockout

EVENT DATE: 06/25/94 LER #: 94-007-00 REPORT DATE: 08/01/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 47

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Jairo Pinzon - Staff Engineer TELEPHONE: (512) 972-8027

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: EB COMPONENT: RLY85 MANUFACTURER: W120
B EB CAP W120
REPORTABLE NPRDS: YES
YES

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On June 25, 1994, Unit 2 was in Mode 1 at 47% power. At 1715 hours, a Main Transformer Lockout Relay actuated. This tripped the Main Turbine, the Generator output breaker, the breakers for all four 13.8 kV auxiliary buses and two switchyard breakers. This caused a loss of power to all Unit 2 auxiliary power busses which resulted in a loss of all Reactor Coolant Pumps and a reactor trip on Reactor Coolant Pump undervoltage at 1715 hours. The plant was stabilized in Mode 3. The cause of the trip was the failure of a capacitor within the pilot wire relay. Corrective actions are described within the Licensee Event Report.

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END OF ABSTRACT

DESCRIPTION OF EVENT:

On June 25, 1994, at 1534 hours, with Unit 2 in Mode 1 at 47% power, a pilot wire relay trouble annunciator alarmed along with the plant computer main transformer primary pilot wire alarm point. Actions were taken as required by the annunciator response procedure. Specifically, the operator first verified the absence of a valid transformer fault, reviewed the logic diagrams, and then contacted the system load dispatcher. The dispatcher was requested to send a technician to investigate the corresponding relays in the switchyard substation. Upon arrival at the switchyard, the technician attempted to reset the alarm; it would not reset. No indications changed on the control room primary pilot wire relay after the attempted reset of the alarm. The technician reviewed the technical documentation to analyze the observed indications.

At 1715 hours, the Control Room received a main transformer lockout relay trip. This tripped the main turbine, the generator output breaker, the breakers for all four 13.8 kV auxiliary buses and two switchyard breakers which open on a lockout of the main and auxiliary transformers. Power was lost to all Unit 2 auxiliary power busses which caused a loss of all reactor coolant pumps. This resulted in a reactor trip on reactor coolant pump undervoltage. The plant and operator response was as designed and expected. All Engineered Safety Features equipment operated as designed. The plant was stabilized in Mode 3. The NRC was notified at 2023 hours in accordance with 10CFR50.72(b)(2)(ii).

Troubleshooting indicated that a component failure within the Control Room primary pilot wire relay caused an internal power supply to degrade resulting in the initial alarm. Further degradation resulted in a power supply short circuit which resulted in the initiation of a trip signal to the main transformer lockout relay which isolated the main transformer and led to the reactor trip. The faulty pilot wire relay has been returned to the vendor for component failure analysis. The pilot wire relay was replaced. The vendor reports that this failure mode has not been previously reported.

CAUSE OF EVENT:

The cause of the trip can be directly attributed to the failure of a capacitor within the pilot wire relay. This capacitor was used in the circuit for EMF noise suppression of the - 15 volt power supply. When the capacitor shorted, it drew the - 15 volt power circuit up to zero

volts. Loss of the - 15 volt power caused an abnormal response of the operational amplifier on the circuit cards. There is no previous history of the failure experienced in this event. Based on the device history, the trip scenario has a low probability of a repeat occurrence.

CAUSE OF EVENT: (Continued)

Contributing factors to this event were:

o a less than adequate Failure Modes and Effects Analysis of the fiber optic pilot wire relay circuit design,

o the limited scope of licensed operator training on switchyard and transformer protective devices,

o a less than adequate impact assessment of a modification to the pilot wire relay to improve the reliability of the pilot wire system with respect to procedure changes and training,

o a less than adequate annunciator response procedure for the received alarm.

ANALYSIS OF EVENT:

Reactor Trips and Engineered Safety Features Actuations are reportable pursuant to 10CFR50.73(a)(2)(iv). The reactor was brought to an orderly shutdown. All Engineered Safety Features systems functioned as designed. There were no adverse safety or radiological consequences of this event.

The main transformer lockout resulted in a loss of the 13.8 kV auxiliary busses. This caused a loss of power to the Engineered Safety Features E2A transformer and the 4.16 kV Engineered Safety Features Bus E2A, all Reactor Coolant Pumps, and instrument air compressors. Standby Diesel Generator 21 started and loads sequenced on as designed. The Technical Support Center and Balance of Plant Diesel Generators started on loss of power and loaded. Component Cooling Water pump 2C started as expected on low common header pressure when Component Cooling Water pump 2A stopped due to the loss of power to the 4.16 kV Engineered Safety Features Bus E2A.

The Feedwater isolation valves shut as expected, and when a Lo-Lo Steam Generator water level was reached, the Auxiliary Feedwater Pumps started.

Auxiliary Feedwater flow was controlled and Main Steam Isolation Valves were shut to control cooldown rate. The Centrifugal Charging Pump suction was shifted from the Volume Control Tank to the Refueling Water Storage Tank.

When Reactor Coolant System loop D cooled to 540 F, emergency boration was initiated in accordance with the emergency procedure. The Auxiliary Feedwater Pump was secured to slow the cooldown on that loop. Fifty-six minutes after the reactor trip, power was restored to all 13.8 kV busses. Fifteen minutes later a Reactor Coolant Pump was started to provide forced circulation and improved pressure control. Temperature control was established through operation of the Steam Generator Power Operated Relief Valves.

ANALYSIS OF EVENT: (Continued)

At 1727 hours, twelve minutes after the trip, instrument air pressure began to bleed down and the Condensate recirculation isolation valve (FV 7022) failed open allowing an open path between the hot, pressurized Condensate system and Condenser 23. As a result, the water in the system flashed to steam and the collapse of the resulting steam bubbles created a hydraulic transient which moved a small section of Condensate system piping. This hydraulic transient continued for approximately 45 minutes. Structural damage was limited to the steel raining supports in the Turbine Generator Building mezzanine and is considered to be minimal.

Loss of instrument air pressure, a non-safety-related system, prevented operation of the Pressurizer spray valve, isolated the Chemical and Volume Control System letdown flow, and caused the condensate recirculation isolation valve to fail open. As a result of loss of Pressurizer Spray, one Pressurizer Power Operated Relief Valve lifted twice for several seconds to control plant pressure.

CORRECTIVE ACTIONS:

The following corrective actions have been taken or will be taken as a result of this event:

1. The Annunciator Response procedures have been revised to provide instructions on actions to take on receipt of a pilot wire trouble alarm.

2. The faulty pilot wire relay was replaced and was sent to the vendor (ABB Power) for component fault analysis. Corrective actions will be developed as necessary, upon evaluation of the results of the failure analysis.

3. The "Loss of Any 13.8 kV or 4.16 kV Bus" procedure was revised to provide guidance on operation of the Condensate recirculation isolation valve on loss of instrument air to minimize the potential for future hydraulic transients.

4. The modification process will be revised to address consideration of the need for a failure mode and effects analysis as part of the design change process. This action will be completed by October 14, 1994.

5. The adequacy of Licensed Operator training and Control Room annunciator response procedures for switchyard and transformer protective devices will be evaluated and necessary revisions will be identified. The evaluation will be completed by November 3, 1994.

6. Lessons learned from this event including the secondary plant response will be included in Reactor Plant Operator Continuing Training by December 15, 1994.

CORRECTIVE ACTIONS: (Continued)

7. Modifications issued since the beginning of 1993 will be reviewed to assess if compo
ents that have a potential for a plant trip were
added to the design. Based on the results of the review, corrective action, if required, to address the adequacy of the failure modes and effects analysis will be developed. This action will be completed by December 15, 1994.

8. The lessons learned will be included in licensed operator requalification simulator and/or classroom training. The training will include the secondary plant response in particular the response to loss of instrument air and importance of power restoration. This action will be completed by December 15, 1994.

9. The level of required operator knowledge of switchyard and transformer protective devices will be reevaluated by management.

This action will be completed by October 14, 1994. Corrective actions will be developed based on this evaluation.

ADDITIONAL INFORMATION:

The pilot wire relay was designed and built by Westinghouse Corporation (now ABB Power Transmission and Distribution Company, Inc.).

The failed capacitor is a 0.1 UF, 50 volt, ceramic with type XR7 characteristics.

Following the June 25, 1994 event, the Nuclear Regulatory Commission conducted a special inspection to review the conditions surrounding this event. Per conversations with the inspectors, the conclusions of this Licensee Event Report are consistent with those identified during the inspections. Although additional factors may be identified as part of the investigation and the final Nuclear Regulatory Commission report, these items will be handled through the South Texas Project Corrective Action Program.

Licensee Event Report 89-017 regarding a reactor trip and partial loss of offsite power due to a main transformer failure was submitted to the Nuclear Regulatory Commission on August 11, 1989. The most probable cause of this event was the failure of the phase A high voltage bushing in the Main Step-Up Transformer.

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The Light
company South Texas Project Electric Generating Station
Houston Lighting & Power P.O. Box 289 Wadsworth, Texas 77483

August 1, 1994
ST-HL-AE-4843
File No.: G26
10CFR50.73

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Unit 2
Docket No. STN 50-499

Licensee Event Report 94-007
Turbine Trip and Reactor Trip Due to Main Transformer Lockout

Pursuant to 10CFR50.73, Houston Lighting & Power submits the attached Unit 2 Licensee Event Report 94-007 regarding a turbine trip and a reactor trip due to a main transformer lockout. This event did not have an adverse effect on the health and safety of the public.

On July 25, 1994, an extension of the due date of this letter to August 1, 1994, was requested of and granted by Mr. W. B. Jones of NRC Region IV.

If you should have any questions on this matter, please contact Mr. J. M. Pinzon at (512) 972-8027 or me at (512) 972-7800.

G. L. Parkey
Plant Manager,
Unit 2

JMP/esh

Attachment: LER 94-007 (South Texas, Unit 2)

A Subsidiary of Houston Industries Incorporated

LER-94\L94007R0.U2 08/01/94 (7:04am)

c:

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